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Abstract

This paper discusses monetary policy's effects on market behavior instead of the opposite relationship that Gertler and Lown (1999) examined. Sargent (1979) discusses that the rational expectations theory is related to What is the effect of monetary policy on market behavior? Michael Mayberger The Park Place Economist, Volume XXII 79 the term structure of interest rates. He states that long-term yields are a function of current and past short-term rates. In the rational expectations theory, economic choices are based on a rational outlook of all available information and past experiences. The theory suggests that current expectations in the economy are equivalent to what the future state of the economy will be. This contrasts the idea that monetary policy influences the decisions of people in the economy.

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Michael Mayberger

I. Introduction

The recent September 2013 Federal Reserve (FED) meetings showed how much the market obsesses over the FED's bond-purchase program, known as quantitative easing. The FED announced it would continue buying Treasuries and mortgage securities at a rate of \$85 billion a month, which contradicted expectations of investors who speculated that the FED would begin to taper its purchases. The market had an exuberant reaction; the Dow Jones Industrial Average (DJIA), an indicator of stock market prices comprising of 30 blue-chip or reliable stocks listed on the New York Stock Exchange, rose from 15,490.16 points at 2pm EST to 15,703.76 points at 3pm EST, a 1.36% increase in one hour. With this sudden increase in the DJIA resulting from a FED decision, the question arises: what is the effect of monetary policy on market behavior?

Knowing the relationship between monetary policy and market behavior could aid an investor or a bond issuer on making investment decisions based on recent FED actions. If a prominent relationship exists between monetary policy and market behavior, a bond issuer will be more knowledgeable about future bond market behavior with information about how changes in monetary policy affect the bond market, such as increasing bond interest rates. The goal of this paper is not to predict future market behavior, but rather to help an investor

or bond issuer analyze what direction the bond market will move based on monetary policy fluctuations.

Because the bond market in the U.S. is so immense with an outstanding debt in 2012 totaling \$38.13 trillion, any advantage an investor or a bond issuer can obtain in determining investment decisions is important. The relationship between monetary policy and market behavior has always existed, but the recent FED decision to continue its quantitative easing program warrants a need to revisit the relationship.

The relationship between market behavior, shown through the High Yield Spread, and monetary policy has been researched extensively. Available research focuses on how monetary policy is affected by the High Yield Spread. Financial accelerator theory states that an adverse shock to the economy may be amplified by worsening financial market conditions. Therefore, Gertler and Lown (1999) argue that the High Yield Spread is likely to have greater marginal forecasting power for real activity. This suggests that changes of the High Yield Spread can be used by the FED to help make monetary policy decisions.

This paper discusses monetary policy's effects on market behavior instead of the opposite relationship that Gertler and Lown (1999) examined. Sargent (1979) discusses that the rational expectations theory is related to

the term structure of interest rates. He states that long-term yields are a function of current and past short-term rates. In the rational expectations theory, economic choices are based on a rational outlook of all available information and past experiences. The theory suggests that current expectations in the economy are equivalent to what the future state of the economy will be. This contrasts the idea that monetary policy influences the decisions of people in the economy.

Amihud and Mendelson (1991) helped develop this theory by connecting yields to liquidity. They state that returns on assets should be an increasing function of their illiquidity, shown in bonds. The longer the time to maturity of a bond is, the higher its risk premium should be since the asset cannot easily be sold or exchanged for cash without a substantial loss in value. Amihud and Mendelson (1986, 1989) also demonstrate the same relationship in stocks. They show that common stocks with lower liquidity yield significantly higher average returns, after controlling for risk and other factors.

Using vector autoregression (VAR), Ang and Piazzesi (2003) try to explain the direction of the relationship between monetary policy and market behavior. They conclude that incorporating macro factors, such as unemployment and inflation, in a term structure model will further improve forecasts of market behavior. They demonstrate that macro factors explain a significant portion (up to 85%) of movements in the short and middle parts of the yield curve, but explain only around 40% of movements at the long end of the yield curve. This develops Sargent's (1979) claim of long-term yields are a function of current and past short-term rates.

The relationship between monetary policy and market behavior has been researched in both directions. Fontaine and Garcia (2007) test the relationship

of monetary policy's effect on market behavior by showing that when the "funding liquidity" factor predicts low risk premium for the newest issued bonds and outstanding bonds, it simultaneously predicts higher risk premium on LIBOR loans, swap contracts, and corporate bonds. In conjunction with the previous study, Acharya, Amihud and Bharath (2010) investigate the exposure of the U.S. corporate bond returns to liquidity shocks of stocks and Treasury bonds over the period of 1973 to 2007. They demonstrate that a decline in liquidity of either stocks or Treasury bonds produces conflicting effects. Prices of investment-grade bonds rise while prices of speculative grade bonds fall substantially. These two studies demonstrate monetary policy's effects on market behavior.

Inversely, using an ordinary least squares (OLS) regression of monthly data from the International Monetary Fund's International Financial Statistics database, Mody and Taylor (2003) show that the financial accelerator theory creates a more robust foundation for the High Yield Spread as a predictor of future real macroeconomic activity. In contrast, Gilchrist & Leahy (2002) show that asset prices should not be included in monetary policy. These two works imply that the High Yield Spread is an excellent predictor of future real macroeconomic activity due to the financial accelerator theory. However, asset prices change rapidly and the reasons for these changes are not always clear, so monetary policy should not include asset prices in its rules.

While the majority of research has been conducted on market behavior's effect on monetary policy, this study will examine monetary policy's effects on market behavior using an OLS regression. Current papers investigating this particular relationship have a much more focused approach than this broader study. This study looks at monetary policy through the TED Spread and how

changes in the TED Spread affect the High Yield Spread.

The rest of the paper will proceed with an explanation of the data and methodology used for the regression in Section II. All the variables will be clarified and the methods of running the regression will be explained. In Section III, the results from the regression will be discussed and evaluated. Finally, the conclusions and policy implications will be discussed in Section IV.

II. Data & Methodology

The TED Spread will measure monetary policy. It is the difference in the LIBOR, the 3-month London Interbank interest rate, and the 3-month Treasury bill, which is a debt obligation backed by the U.S. government with a maturity of 3 months. The TED Spread represents a quantifiable measure of monetary policy as well as perceived credit risk within the economy. Since the FED determines the 3-month Treasury bill on a daily basis, it relatively controls the TED Spread.

To measure market behavior, the High Yield Spread will be used. The High Yield Spread (for the sake of this paper) is the difference in Bank of America Corporate BBB bonds and Bank of America Corporate AA bonds based on Standard and Poor's (S&P) bond ratings. S&P grades bonds based upon credit worthiness on a scale of AAA to D with AAA being the highest rating and D being the lowest. The High Yield Spread measures the amount of risk present within the market at a given time. The higher the High Yield Spread, the more risk that is taken on when a BBB bond is purchased. Inversely, when the spread is lower, the risk assumed in both AA bonds and BBB bonds is more closely related.

To capture as much market risk as possible, a control variable will be used. The Volatility Index (VIX) for the NASDAQ

and the DJIA will serve this purpose. The NASDAQ relates to BBB bonds as it has a variety of stocks including some junk equities. The DJIA can be related to AA bonds, or high quality bonds. The difference of the VIX NASDAQ and the VIX DJIA will be equated to the VIX Spread which will be used as a control variable which will help determine stock market risk at a given time.

The data—the TED Spread, the High Yield Spread, and the VIX Spread—are all expressed in basis points and were compiled from the online FRED Database and exported to Microsoft Excel. Due to the availability of the daily data, the range is from February 2, 2002 to October 18, 2013, or 3,268 observations. Table 1 in the Appendix shows descriptive statistics of the TED Spread, High Yield Spread, and VIX Spread. The maximum value of the TED Spread is 4.58 registered in October 2008 while the minimum value is 0.09 registered in March 2010. The maximum value for the High Yield Spread is 3.99 registered in January 2009 while the minimum value is 0.33 registered in September 2008. The TED Spread's maximum value was recorded at the height of the 2008 recession while the High Yield Spread's minimum value was registered during the same time period. This suggests a negative relationship between the TED Spread and the High Yield Spread based on the plotted data.

Figure 1 in the Appendix shows the TED Spread and the High Yield Spread graphed in levels. There appears to be a negative relationship between the two series from 2002 until the 2008 recession. The TED Spread slowly increases while the High Yield Spread decreases at a much faster rate from 2002 until the 2008 recession. Once the recession starts, the TED Spread increases significantly in volatility until October 2008 when it decreases just as quickly as it rose. The High Yield Spread also increases but does not decrease until May 2009. After the recession

and subsequent decreases, both spreads are fairly constant.

This dataset is strong in its large number of observations. With almost a decade worth of daily frequency data, this dataset has the potential to display a relationship between the TED Spread and the High Yield Spread. However, the daily frequency is also a limitation. Only one control variable can be accounted for due to the frequency, so more variables could strengthen this dataset.

An Ordinary Least Squares (OLS) regression will be run to determine the effect of monetary policy on market behavior. In order to fit the series into an OLS regression, linearity must be induced. So, the logarithms of both the TED Spread and the High Yield Spread will be taken to induce linearity. Figure 2 in the Appendix shows the TED Spread and the High Yield Spread plotted in logarithms. Figure 2 displays a negative relationship between the TED Spread and the High Yield Spread just like Figure 1 did even when logarithms were taken to induce linearity. Additionally, due to the spikes in the data caused by the 2008 recession, as shown in Figure 1, a dummy variable will be created for the year 2008. This will account for the volatility in the series during this year. Furthermore, lag variables will be created for the High Yield Spread as well as the VIX Spread to determine if past observations are predictive variables. All of these transformations will be done using the software package, EViews 7, which will be used to run the OLS regression for this time series analysis. The equation used to determine the effect of monetary policy on market behavior is:

$$\text{High Yield Spread} = \alpha + \beta_1(\text{High Yield Spread})_{t-1} + \beta_2(\text{TED Spread}) + \beta_3(\text{VIX Spread})_{t-3} + \beta_4(\text{Dummy 2008}) + \varepsilon(t)$$

The TED Spread is the independent variable because this can be relatively manipulated by the FED. The High Yield Spread is the

dependent variable because it is the goal of this paper to examine the High Yield Spread's relationship with the TED Spread. The expected sign of the coefficient of the TED Spread is negative because when the TED Spread increases, it is assumed by lenders that the risk of default on interbank loans has increased. This should cause a shift to safer bonds, 3-month Treasury bonds, which will cause riskier bonds' interest rates to rise. This makes the High Yield Spread increase. This prediction is also supported by Figure 1 and Figure 2 displaying a negative relationship between the TED Spread and the High Yield Spread.

By running an OLS regression, the effect of monetary policy on market behavior can be studied over time. The large dataset used is particularly helpful to strengthen this type of analysis. A limitation is the control variables; since the frequency is daily, it is difficult to find data with the same frequency and range.

III. Results

In order to run an OLS regression, logarithms were taken of the data in order to induce linearity. Based on the Augmented Dickey–Fuller (ADF) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests, the series was differentiated once as the second transformation. For the ADF test for the presence of a unit root in levels, do not reject the null hypothesis that the variables (Log of High Yield Spread and Log of TED Spread) have a unit root. But in first order differences, reject the null hypothesis that the variables (Log of High Yield Spread and Log of TED Spread) have a unit root. For the KPSS test for stationarity, do not reject

the null hypothesis in levels that the variables (Log of High Yield Spread and Log of TED Spread) are stationary. Similarly, in first order

differences do not reject the null hypothesis that the variables (Log of High Yield Spread and Log of TED Spread) are stationary. Based on the ADF and KPSS test results, the series is stationary in first order differences, so this transformation should be used when transforming the data into growth rates.

Table 2 in the Appendix shows the results from the regression. A lag variable of one time period was taken of the High Yield Spread and a lag variable of three time periods was taken of the VIX Spread. The constant had a negative sign, but it was not statistically significant, so the long term mean is equal to zero which is what we expect as we have previously induced stationarity. The lag variable of the High Yield Spread was statistically significant and had a negative magnitude of -0.41. This means that a 10% decrease in the High Yield Spread from a previous day should result in a 4.1% increase in the current period. The lag variable of the VIX Spread was not statistically significant which shows that the VIX Spread does not affect the High Yield Spread. Different lag variables were considered, but the VIX Spread still remained statistically insignificant. The dummy variable was statistically significant and had a positive magnitude of 0.008 for the year 2008. The TED Spread variable, the most important variable, was statistically significant with a negative magnitude of -0.097. This means that a 10% increase in the TED Spread will result in a -0.97% change in the High Yield Spread. This shows that there is a very slight negative relationship between the TED Spread and the High Yield Spread. When the TED Spread increases, the High Yield Spread decreases.

The overall goodness of fit is shown in Table 2 in the Appendix; the R-squared equals 0.19, meaning that only 19% of the variance in the independent variable can be explained by the regression. Such a low percentage is typical of a time series analysis. The F-statistic

is 195.19 and is statistically significant which shows that the model is highly significant.

Figure 3 in the Appendix shows the plot of the residuals to facilitate residual diagnostics of the regression. We looked at the White's Test for heteroskedasticity, the Breusch-Godfrey test for autocorrelation, and the Jarque Bera test for normality. For all the tests, we reject the null hypotheses that the residuals are homoskedastic, that they are not autocorrelated, and that the residuals are distributed normally. This calls into question the reliability of the regression because it is evident that there is some variability that is not explained by the regression. As shown in Figure 3, the large spike in 2008 is the cause of the residuals not fitting the model.

IV. Conclusions

This paper uses an OLS regression with daily data obtained from the FRED Database with a range of February 2, 2002 to October 18, 2013. The variables examined are the High Yield Spread, Bank of America Corporate BBB bonds minus Bank of America Corporate AA bonds, the TED Spread, 3-month LIBOR rate minus 3-month Treasury bills, and the VIX Spread, VIX NASDAQ minus VIX DJIA. The TED Spread is the independent variable while the High Yield Spread is the dependent variable. The TED Spread has a negative magnitude of -0.097 and is statistically significant. Therefore, a very slight negative relationship between the TED Spread and the High Yield Spread is present. If a 10% increase in the TED Spread occurs, the High Yield Spread decreases by only 0.97%. Because of the small magnitude of this relationship, the TED Spread can only marginally predict changes in the High Yield Spread. Increases to the TED Spread will signal to bond issuers and investors that the High Yield Spread will decrease, but not enough to command taking immediate actions. The 2008 recession could have had a large impact on the regression results as such a

small negative relationship was not predicted based on plotting the data in levels.

The negative relationship between the TED Spread and the High Yield Spread is consistent with the rational expectations theory as stated by Sargent (1979). The theory suggests that current expectations in the economy are equivalent to what the future state of the economy will be, which contrasts the idea that monetary policy influences the decisions of people in the economy. This would result in a negative relationship between movements of the TED Spread and how the markets react as shown in the High Yield Spread.

Future avenues of research could include adding additional control variables such as indexes, futures, swaps, and derivatives. The daily frequency of the dataset creates a problem as many macroeconomic variables such as the unemployment rate and inflation cannot be added due to a lack of daily data. By adding variables such as different indexes, futures, swaps, and derivatives, a broader picture of the financial markets can be captured. Another problem with these regression results may be the effect of the 2008 recession on the relationship between the TED Spread and the High Yield Spread. There was only one large recession captured in the dataset, so a comparison with another large recession, like the early 1980s recession, could be valuable in understanding the effect of the 2008 recession on the TED Spread and the High Yield Spread.

Based on the regression results of this paper, investors and bond issuers may change their strategies when it comes to buying, selling, or issuing bonds. Due to the slight negative relationship between monetary policy and market behavior, both investors and bond issuers should look at the TED Spread before they buy, sell, or issue bonds. When monetary policy expands the TED Spread, bond issuing

corporations must take this into account as the High Yield Spread will decrease slightly. Conversely, when monetary policy shrinks the TED Spread, the High Yield Spread will increase slightly. These movements of the TED Spread can signal bond issuing corporations to upcoming changes of the High Yield Spread and thus, changes in bond interest rates. This negative relationship between the TED Spread and the High Yield Spread could result in an important, albeit small, change in the workings of the bond market.

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Appendix

Table 1: Table 1: Descriptive Statistics of TED Spread, High Yield Spread, and VIX Spread

	Maximum	Minimum	Mean	Median	Std Deviation
TED	4.58	0.09	0.46	0.30	0.48
High Yield	3.99	0.33	1.42	1.38	0.63
VIX	43.87	-2.43	7.82	4.83	7.85

Figure 1: Plot of TED Spread and High Yield Spread in levels

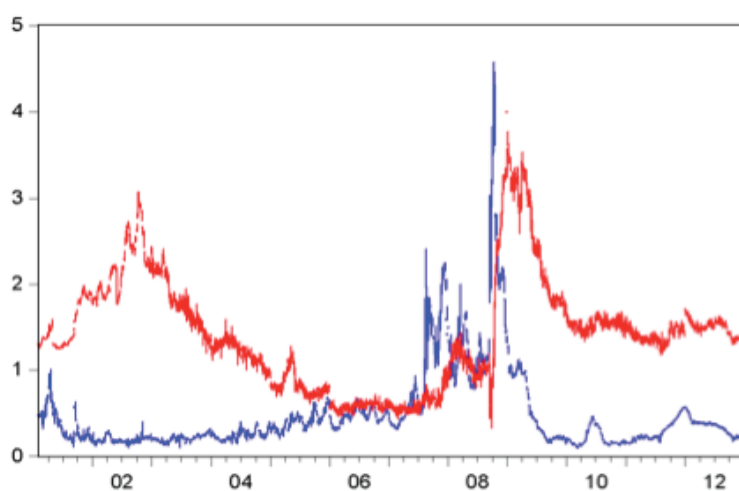


Figure 3: Plot of Residuals

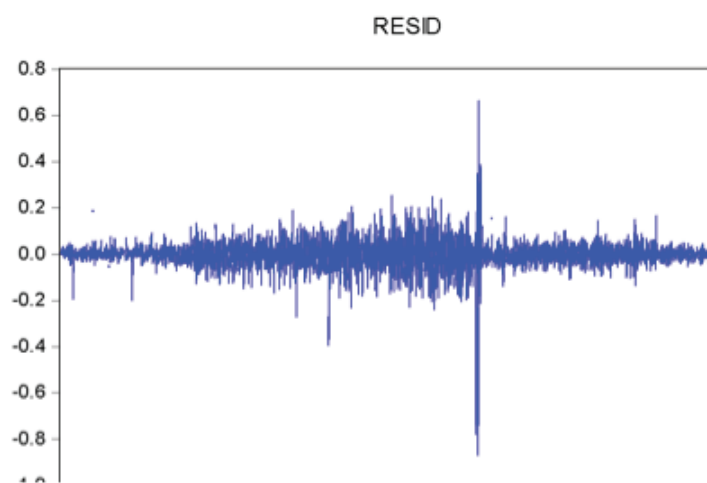


Table 2: Regression Results

Dependent Variable: High Yield Spread	
Variable	Coefficient
High Yield Spread (1 lag)	-0.0414*** (-26.301)
TED Spread	-0.097*** (-8.331)
VIX Spread (3 lags)	0.006 (-1.068)
Dummy 2008	0.008** (-2.084)
R-Squared	0.193
F-Statistic	195.189
Sample Size	3,268

***Significant at the 1% level

**Significant at the 5% level

*Significant at the 10% level

Figure 2: Plot of TED Spread and High Yield Spread in levels (log)